Department of Liberal Education
Era University, Lucknow
Course Outline
Effective From: 2023-24

Name of the Program	**B.A. / B.Sc. (LIBERAL EDUCATION)**			**Year/ Semester:**	**3rd / 5th**
Course Name	**Renewable Energy**	**Course Code:**	**EVA301**	**Type:**	**Theory**
Credits	**03**			**Total Sessions Hours:**	**45 Hours**
Evaluation Spread	**Internal Continuous Assessment:**	**40 Marks**		**End Term Exam:**	**35 Marks**
Type of Course	○ Compulsory	◉ Core		○ Creative	○ Life Skill
Course Objectives	1. To provide students with an understanding of the conventional and non-conventional energy resources and issues related with their consumption on environment, economy, and society. 2. To introduce students with energy harnessing through renewable technologies, and their role in meeting future energy demands. 3. To learn about limitations affecting large scale production and usage of renewable resources.				

Course Outcomes (CO): *After the successful course completion, learners will develop following attributes:*

Course Outcome (CO)	**Attributes**
CO1	Learn about environmental, social and economic impacts of energy resource utilization.
CO2	Identify renewable resources and learn policies and programs adopted at national level to channelize renewable energy.
CO3	Learn mechanism of renewable energy production, application and associated benefits and challenges.
CO4	Students will be able to understand the potential of biomass in production of renewable energy.
Pedagogy	Interactive, discussion-based, student-centered, presentation.
Internal Evaluation Mode	Mid-term Examination: 20 Marks Class test: 05 Marks Online Test/Objective Test: 05 Marks Assignments/Presentation: 05 Marks Attendance: 05 Marks

Session Details	**Topic**	**Hours**	**Mapped CO**
Unit 1	**Energy Resources, Environment and Society** • Energy: Definition, forms and importance • Energy demand & consumption: Present and future scenario • Conventional energy: Impact on environment & economy • Need for energy efficiency, energy-efficient appliances • Low-carbon energy transition; zero emission: Fact or myth	10	CO1
Unit 2	**Solar and Wind energy** • Solar energy: Introduction; solar radiation spectrum and solar insolation	12	CO2, CO3

	• Solar devices: Solar PV cell, solar heating system • Jawaharlal Nehru Solar National Mission: Objectives and present status • Wind energy: Introduction, principles & application • Green Energy Corridor: Concepts & objectives		
Unit 3	**Hydropower, geothermal and hydrogen energy** • Hydro-energy: Power generation-Concept and potential • Hydroelectricity: Benefits & challenges • Geothermal energy- Concept & energy production potential • Application, benefits & limitation • Hydrogen energy- Concept, application & challenges	11	CO3
Unit 4	**Ocean and Biomass based energy** • Ocean energy: Concept, principles & types • Tidal power generation: technologies used, benefits & drawbacks • Wave energy: Energy conversion, advantages and challenges • Biofuels: Concept, types and method of production • Application, advantages and challenges	12	CO3, CO4

CO-PO and PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	2	3	2			3		3		3		3	
CO2	2	2	3	2			3		3		3		3	
CO3	2	2	3	2			3		3		3		3	
CO4	2	2	3	2			3		3		3		3	

Strong contribution-3, Average contribution-2 , Low contribution-1,

Suggested Readings:

Text- Books	1. Mehmet Kanoglu, Yunus A. Cengel, John. M. Cimbala. 2020. Fundamentals and Application of Renewable Energy. McGraw Hill publishers. 1st edition 2. S. C. Bhatia & R. K. Gupta. 2018. Textbook of Renewable energy. Woodhead Publisher. 1st edition
Reference Books	1. Craig. J.R., Vaughan, D.J., Skinner. B.J. 1996. Resources of the Earth: Origin, use, and environmental impact (2nd edition). Prentice Hall, New Jersey. 2. Mallon, K. 2006. Myths, Pitfalls and Oversights, Renewable Energy Policy and Politics: A Handbook for Decision-Making. Earth Scan.
Para Text	**Unit 1:** 1. Global energy demand - https://www.bp.com/content/dam/bp/business-sites/en/global/corporate/pdfs/energy-economics/statistical-review/bp-stats-review-2021-full-report.pdf **Unit 2:** 1. Renewable energy resources - https://www.edfenergy.com/for-home/energywise/renewable-energy-sources; https://www.nationalgeographic.org/encyclopedia/non-renewable-energy/ **Unit 3:** 1. Hydropower-https://www.energy.gov/eere/water/hydropower-basics **Unit4:** 1. Biomass energy-https://youtu.be/7cCSV0IO4zE

Recapitulation & Examination Pattern		
Internal Continuous Assessment:		
Component	**Marks**	**Pattern**
Mid-term Exam	20	**Section A:** Contains **10** MCQs/Fill in the blanks/One Word Answer/ True-False type of questions. Each question carries **0.5 marks.** **Section B:** Contains **07** descriptive questions out of which **05** questions are to be attempted. Each question carries **03 marks**.
Class Test	05	Contains **05 descriptive questions.** Each question carries **01** marks.
Online Test/ Objective Test	05	Contains **10 multiple choice questions.** Each question carries **0.5** marks.
Assignment/ Presentation	05	Assignment to be made on topics and instruction given by subject teacher.
Attendance	05	As per policy.
Total Marks	**40**	

Course created by: Dr. Swati Sachdev **Signature:**	**Approved by: Prof. Venkatesh Dutta** **Signature:**